COGNITIVE ARCHITECTURE: ORCHESTRATOR OF INNOVATION IN ORGANIZATIONS

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Abstract: *Management of Organizational Knowledge which drives innovation has always been considered as the key to performance and resultant sustained competitive advantage. This axiom is even more applicable in the 21st century where the business environment has been labeled as hypercompetitive.*

Research on innovation has shown that it is a non linear, disjunctive, iterative and cyclical process. Yet the architecture and process steps are not clear. The question remains as to how organizations determine which system to follow? Why some firms are able to successfully explore and exploit ideas and some falter even though they are exposed to the same business environment. Why do spillovers occur? The core question remains is what orchestrates the process of innovation and therefore what determines innovativeness in organizations?

This paper attempts to find an answer to this enigma. It looks at how two health care systems attempted to achieve targeted health indices and associated demographic transition. Using a comparative case design, this processual study establishes that a functional "cognitive architecture" orchestrates the process of innovation at the organizational level. It is this structural element which focuses organizational attention on idea identification in line with organizational objectives, drives the organizational processes which test, adapt and successfully diffuse these innovations. Thus this paper contributes by resolving the role of structural elements that drive the process of innovation.

Key words: *Organizational attention; Cognitive architecture; Open innovation; structural components*

INTRODUCTION:

In management, performance of organizations is the central concept which is researched extensively. It is a truism that consistent adaptation to changing business environment and customer needs determines a firm's ability to maintain sustained competitive advantage. Be

it private or public sector, there is no denial that the organizational processes leading to consistent innovativeness on part of firms is what leads to consistent adaptation to changing business environment and customer needs. Innovativeness in firms is a function of risk taking leading to creativity, knowledge management especially knowledge generation and finally taking the creative idea to fruition through competency development and its exploitation.

The fact that this successful cycle of creation to fruition is not widely seen and replicated is a pointer to how difficult it is and that our understanding of factors influencing this cycle is incomplete. For eg why some firms are able to successfully explore and exploit ideas. Why do some firms fail to exploit ideas, even though they are exposed to the same business environment or why do spillovers occur? The core question remains is what orchestrates the process of innovation and therefore what determines innovativeness in organizations?

This paper takes the stance that firms wanting to be highly innovative need to be focused on what creative ideas are emerging in the business landscape which can facilitate their achievement of sustained competitive advantage or high performance. Be in closed form of innovation through research and development or open innovation through collaborative mechanisms of research and development, attention of the firm (ocasio 1997) is what determines what ideas get recognized at the strategic level by the firm. This attention, driven through a functional structural element called Cognitive architecture (Amin and Cohendet 2004), is what dictates the content of innovation in a firm. This paper brings this key message through a comparative case study of the public health system at the state level in India. The paper is structured as follows—after the introduction and positioning of the concept in relevant literature, the paper brings the methodology, the cases and its analysis. After this is the discussion on how the case analysis corroborates and brings forth the key message. Finally the paper ends with the frame work generated out of the discussion which highlights the key contribution of the paper.

LITERATURE REVIEW:

Organizational knowledge and knowledge brokering: Management of Organizational Knowledge which drives innovation has always been considered as the key to sustained competitive advantage and resultant performance. This axiom is even more applicable in the 21st century where the business environment has been labeled as hypercompetitive.

Research on innovation has identified two streams of activities –a closed system where the entire process of innovation is driven by within organization boundary activities (damanpor 1991) and an open system where the entire process is interlinked with activities lying outside the organizational boundaries (Chesbourgh 2005). Literature on knowledge brokering has tried to show how organizational mechanisms attempt to foster innovation.

Innovation process is dialectical, nonlinear, cyclical, disjunctive and iterative (Anderson, Dedreu and Nijstad 2004). This requires organizations to be flexible and focused; committed and open minded and oriented towards market and technology. This necessitates that process of innovation be dynamic and timing of introduction of activities into the process critical. These features are not emphasized in research (Nystrom 1998). A striking finding of a recent extensive review of research on innovation is that only a tiny proportion of empirical studies that explicitly set out to study the process of innovation (Crossan and Apaydin 2010). Internal rigidities to innovation have also not been researched empirically. This has reflected in a shortage of operationally grounded models and "how to" details. Hence details of the architecture that drives innovation in firms is still nebulous (Dobni 2006).

However fragmented, still Research has identified that closer interaction with user is essential for success in the process view of innovation. Internal organization is preferred when activities are complimentary and collaboration preferred when activities are discontinuous or uncertain (Leiponen 2005). Studies do show that separation of exploration and exploitative activities as active response to overcome rigidities in the innovation process (Kuepp and Gassmann 2009).

Innovativeness is the capability or skill in a firm which translates potential of ideas to successful product or service. Firms differ in their degree of innovativeness. Firms differ in the breadth (no of users) and depth (degree of interaction with each user), their ability to take risks, their consistency of financial allocation to process of innovation and their linkages with outside agencies (Schilling and Werr 2009). Yet empirical validity of this architecture of innovation signifying innovativeness of a firm is not seen (Crossan and Apaydin 2010).

By identifying this knowledge on how the process of innovation is orchestrated is what will allow us to answer the questions under reference in the paragraphs above.

RESEARCH DESIGN AND METHODOLOGY:

This study emanates from a doctoral dissertation having a multiple case embedded design, a longitudinal processual study across multiple levels (Narayana 2010). The unit of analysis was a health care program with the administrative units acting as embedded unit of analysis. Units serving as exemplars based on performance in chosen programmes were used as sample. National Health care programmes offer a context in the service industry and allow the study of programmes with standard components and technology in use for delivery of service but in a variety of local contexts. This paper is based on a comparative analysis of the Reproductive and child health (RCH) programme in the states of Gujarat and Tamil nadu.

DATA COLLECTION AND ANALYSIS:

Formal approval for participation in the study was secured. Key participants facilitated identification of other participants for interviewing. Semi structured interviews were conducted of key participants using a set of open ended case study questions as a guide to start with. . Secondary data and documents were obtained from the directorate, department of finance, and official websites of the state government. The case study analysis was developed using case descriptions as an analytical strategy (Yin 2003, p 114).Analysis of case studies was done using a combination of contextualizing strategies; as the contextual relationships among the data is necessary for generating alternative explanations from the data; and categorizing strategies, since the effort as to see what the field data was indicating and do a comparison among units studied. Memos and displays aided the generation of patterns and their matching (Maxwell 1998).

RESEARCH SETTING:

The national health policy (2002) sets guidelines for states to follow and envisages achievement of Infant mortality rate (IMR) of <30/1000 live births; maternal mortality rate (MMR) of <100/ lakh live births and utilization of public facilities to >75% by the year 2010 Under RCH.

The present research cases are set in the states of Tamil nadu (TN) and Gujarat in India. A comparative socio-demographic profile is given below:

Table 1: Socio-demographic profile of Tamil nadu and Gujarat

Dimension(figures from 2001 census)	Gujarat	Tamil nadu
Area	196022 sq km	129707 sq km
Population (2001 census)	50.6 million	62 million
Population density	280/sqkm	478/sqkm
Decadal growth rate of population(1991-2001)	22.16%	11.16%
Urban population	37%	44%
Life expectancy at birth	63.6 yrs	68.4 yrs
Sex ratio /per 1000 males	920	987
Female literacy	59%	64.4%
Utilization of key government schemes	50%	60%
Location in India	West	South

Organizational structure: The directorates of medical education, medical and rural health services and public health and preventive medicine form the back bone of the state's health department. Technical people assist the secretary in formulation and implementation of the health policy. The directorate of public health and preventive medicine is responsible for the implementation of various National and State Health programmes and does it through the rural health system.

The rural health system, at the lowest level, consists of a primary health centre(PHC) with a set of networked sub-centers under its control. Each PHC is linked to a referral unit. A set of PHCs and referral units make a health system at the district level --the basic administrative unit. A large training infrastructure is there to facilitate programmed Training of all staff and medical officers. It includes basic, programme specific and management capacity building courses.

The Reproductive and child health programme: Population stabilization has been a prime concern in India and the family planning programme subsuming all components of RCH was started in 1951.Seggregation of components as individual programmes and their reintegration has occurred over time. From 1997, however, it is run as an integrated programme. The services under RCH can be categorized based on skill levels and facilities required in delivery of service. At low end are the immunization services, followed by health education, ante-natal care, conduct of deliveries, new born care and finally management of obstetric and neonatal complications. The hospital component increases with increase in skill levels required (See Table 2a and 2b).

Table 1 A Services under the RCH programme

Component	Services	Category	Place of service delivery	Deliverer of service	Outcomes
Maternal health	Ante natal check up	Normal pregnancies	Sub-centre, ICDS centre	VHN	Identification of high risk pregnancies
		High risk pregnancies	PHC	MO, Specialist	Detect complications
	Conduct of delivery	Normal pregnancies	PHC	Staff nurses	Detect complications
		High risk pregnancies	BEmONC	Staff nurses, MO	Manage complications
		High risk pregnancies	Referral Units	Staff nurses, Specialists	Elective Cesarean operation
	Post natal check up	Normal pregnancies	Sub centre	VHN	Detect complications
		High risk pregnancies	PHC	MO, Specialists	Detect complications

Table 1B

Component	Services	Category	Place of service delivery	Service deliverer	Outcomes
Child health	New born care	Normal babies	Sub centre	VHN	Detect complications
		High risk babies	PHC	MO, Specialists	Detect complications
		High risk babies	Referral Units	Specialists	Manage complications
	Immunization, Growth monitoring, use of ORT, Tackle respiratory diseases	All	Sub-centre, ICDS centre, PHC	VHN,MO	Development of child, Health education of mother
	School health	All	Schools	MO and Staff	Detect disease conditions
Adolescents	Counseling	All	Schools	VHN, Link workers	Health education
Women	RTI/STI clinics	All	PHC	MO	Detect disease conditions
Family welfare	Contraception	All	PHCs,	VHN, MO	Lower fertility

Performance under RCH: Tamil nadu, in 2006, had achieved the two objectives of <=30 (IMR) and <100 (MMR) as envisaged in the national health policy (2002) under RCH. It had a birth rate of 15.8; a death rate of 6.1; an IMR of 30, and an MMR of 90. Except for the state of Kerala, which had achieved these objectives much earlier (IMR of <30 IN 1987; and MMR of < 100 in 2004) all the other states are well behind these targets including Gujarat.(see table 3).

The table on comparative data (see table 3) over time for select states indicates that Tamil nadu has consistently performed well over time resulting in achievement of RCH programme objectives.

The next part of the paper attempts to find the answers as to why TN did better than Gujarat. We first give the gist of the cases analyzing the progress in RCH programme over time in both the states. This is followed by a comparative analysis on key elements of the processes adopted for implementation of the programme especially the process of innovation.

Table 3: Comparison of key indicators

	BIRTH RATE			DEATH RATE			INFANT MORTALITY RATE			TOTAL FERTILITY RATE		
Year	TN	India	Gujarat	TN	India	Gujarat	TN	India	Gujarat	TN	India	Gujarat
1971	31.4	36.9	38.6	14.4	14.9	15.7	113	129	144	3.9	5.2	5.6
1972	32.4	36.6	38	15.1	16.9	14.6	121	139	128	3.9	5.2	5.6
1973	30.0	34.6	36.9	14.1	15.5	14.7	108	134	161	3.7	4.9	4.9
1974	29.2	34.5	37.6	13.9	14.5	14.6	106	126	109	3.6	4.9	5.4
1975	30.7	35.2	36.8	15.0	15.9	15.2	112	140	154	3.8	4.9	5.1
1976	30.7	34.4	36.5	14.6	15.0	14.3	110	129	146	3.8	4.7	5.2
1977	29.8	33.0	35.9	13.7	14.7	13.5	103	130	138	3.9	4.5	4.8
1978	28.8	33.3	35.5	12.8	14.2	12.6	105	127	122	3.5	4.5	4.8
1979	28.9	33.1	35.1	12.1	12.8	12.4	100	120	123	3.6	4.4	4.6
1980	27.9	33.3	35.8	11.2	12.4	12.2	93	114	113	3.4	4.4	4.7
1981	28.0	33.9	34.5	11.8	12.5	12	91	110	116	3.4	4.5	4.3
1982	27.7	33.8	34.3	11.2	11.9	11.7	83	105	112	3.3	4.5	4.2
1983	27.9	33.7	34.2	11.7	11.9	11.6	87	105	106	3.3	4.5	4.2
1984	28.0	33.9	33.4	10.8	12.6	10.8	78	104	106	3.3	4.5	4
1985	24.7	32.9	33	9.5	11.8	10.8	81	97	98	2.8	4.3	3.9
1986	23.8	32.6	32.2	9.5	11.1	10.5	80	96	107	2.7	4.2	3.8
1987	24.0	32.2	30.8	9.9	10.9	9.8	76	95	97	2.6	4.1	3.6
1988	22.7	31.5	29.5	9.3	11.0	11	74	94	90	2.5	4	3.4
1989	23.1	30.6	28.7	8.7	10.3	9.7	68	91	86	2.5	3.9	3.6
1990	21.6	30.2	29.6	8.5	9.7	8.9	59	80	72	2.3	3.8	3.4
1991	20.8	29.5	27.5	8.8	9.8	8.5	57	80	69	2.2	3.6	3.1
1992	20.7	29.2	28.1	8.4	10.1	9.2	58	79	67	2.2	3.6	3.2
1993	19.5	28.7	28	8.2	9.3	8.2	56	74	58	2.1	3.5	3.2
1994	19.2	28.7	27.1	8.0	9.3	8.7	59	74	64	2.1	3.5	3.1
1995	20.3	28.3	26.7	8.0	9.0	7.6	54	74	62	2.2	3.5	3.2
1996	19.5	27.5	25.7	8.0	9.0	7.6	53	72	61	2.1	3.4	3
1997	19.0	27.2	25.6	8.0	8.9	7.6	53	71	62	2.0	3.3	3
1998	19.2	26.5	25.5	8.5	9.0	7.9	53	72	64	2.0	3.2	3
1999	19.3	26.1	25.4	8.0	8.7	7.9	52	70	63	2.0	3.2	3
2000	19.3	26.0	25.2	7.9	8.5	7.5	51	68	62	2.1	3.2	2.9
2001	19.1	25.4	25	7.6	8.4	7.8	49	66	60	2.0	3.1	2.9
2002	18.5	25.0	24.7	7.7	8.1	7.7	44	64	60	2.0	3.0	2.8
2003	18.3	24.8	24.6	7.6	8.0	7.6	43	60	57	1.9	3.0	2.8
2004	17.1	24.1	24.3	7.5	7.5	6.9	41	58	53	1.8	2.9	2.8
2005	16.5	23.8	23.7	7.4	7.6	7.1	37	58	54	1.8	2.9	2.8
2008	16	22.8	22.6	7.4	7.4	6.9	31	53	50	1.7	2.6	2.5
2010	15.9	22.1	21.8	7.6	7.2	6.7	24	47	44	1.7	2.5	2.5
2013	15.6	21.4	20.8	7.3	7.0	6.5	21	40	36	1.7	2.3	2.3

THE CASES:

Gujarat: 1996 can be considered the watershed since the entire philosophy of the RCH programme changed to a need based approach (CNAA) and integration of all components was done under one programme in 1997. After 1996, certain policy decisions taken by the state government had a great impact on the functioning of the health system, especially the RCH programme. The implementation of the various initiatives under RCH were affected by the state governments decision to not to follow contractual payment guidelines given by funding agencies for RCH I and insisting on uniform and lower contractual payments for all staff. This decision, based on a fear of "impending increase in expenditure", impeded the operationalisation of FRU's. A ban on filling up of 20% of the regular posts was in place at that time. This fear of "impending increase in expenditure" resulting in uniform and lower contractual payments to field staff was insisted upon when contractual appointments were permitted against existing vacancies to address the issue of manpower shortage. Concomitant but independent decisions to reduce the number of FHW training schools and use a major portion of FHW training slots for FHS training magnified the impact of this fear of "impending increase in expenditure". These decisions reduced the availability of trained FHW for recruitment resulting in persistence of vacancies in this category. Although the government was increasing the number and capacity of medical colleges, better incentives in the private sector resulted in poor induction of medical officers and specialists into the public health system.

This resulted in increased vacancies in the cadre of MO and specialists. It impacted the systems ability to manage the vacancies in the field staff. The lack of initiative on part of CDHO's and delays in confirmation and promotions of field staff only compounded the systems inability to manage the impact of vacancies. This is depicted as figure 1 below.

The state health system also laid less emphasis on training and transfer of skills as a systemic measure. This is evidenced in their poor interaction with the medical colleges for transfer of skills and poor receptivity to introduction of new concepts as seen in the poor implementation of the concept of CNAA. The key training inputs for FHW were not as per regulatory body directives. These resulted in poor transfer of skills and impeded the ability of field staff to render desired levels of services. The government permitted use of community workers, enrollment of PPs and NGOs and allowed use of other cadres to act as

feeder cadres. These provisions mitigated the impact of vacancies in the programmes of NBCP, NVBDCP and RNTCP, but had very marginal impact on RCH services. These mechanisms did not substitute for the work of FHW, MO and specialists under RCH resulting in lack of services.

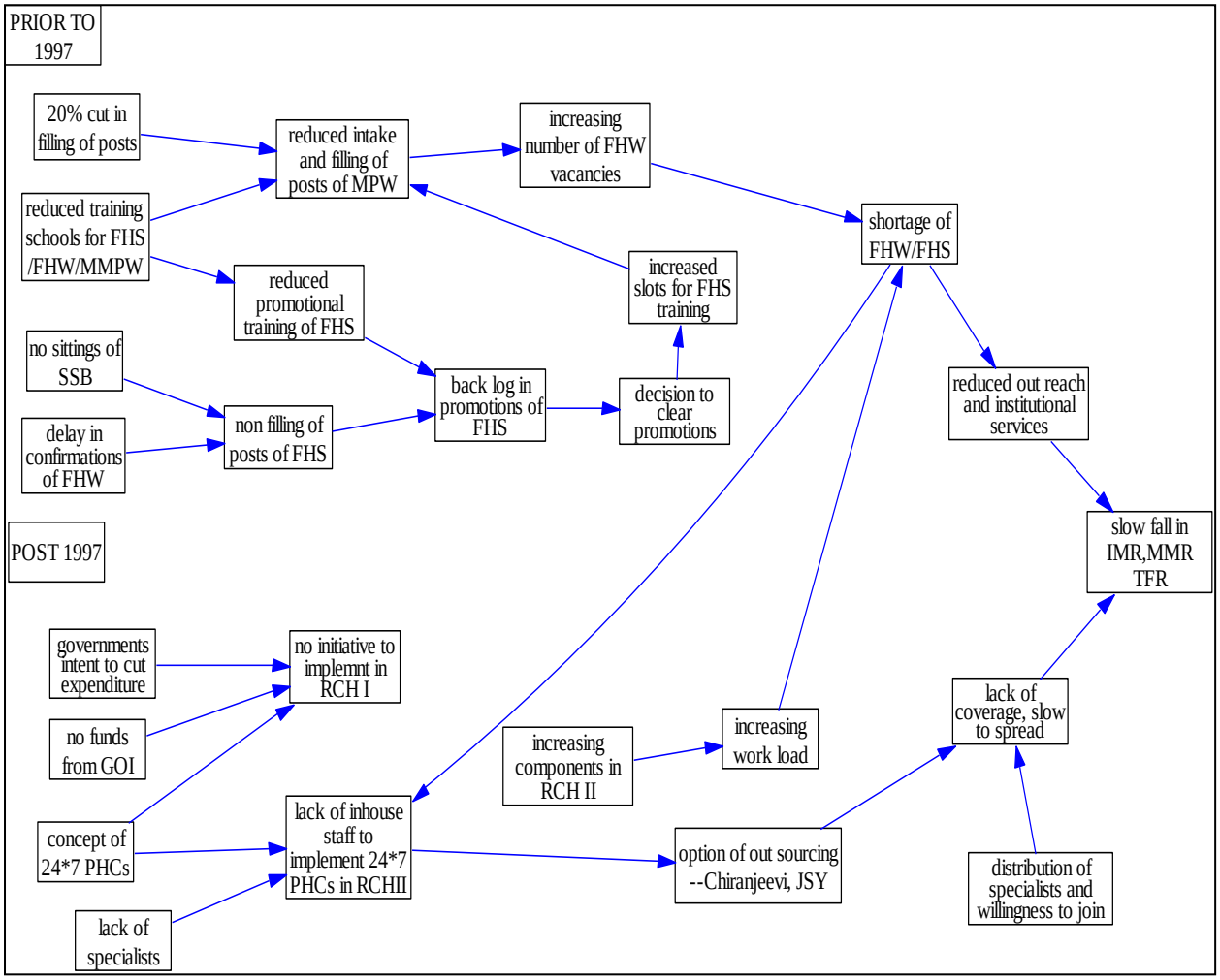

Figure 1: Factors impacting RCH activities in Gujarat

Increasing workload in RCH due to increase in components and therefore services to be delivered under the programme only compounded this problem. Poor reliability of field data led to poor planning. Overbearing and rigid attitude of the headquarters officers resulted in perception of higher targets by field staff. These factors contributed by aggravating the impact of increasing workload. All these considerably affected the "MOs Motivation to produce". This in turn affected their ability to manage vacancies and additional workload through work facilitation measures and supervision. The resultant reduced "Motivation to produce" at the staff level led to reduced and poor quality of outreach and institutional services. This led to a slow fall in the indicators of BR, IMR and TFR.

Tamil nadu: The health system in Tamil nadu over time followed a deliberate strategy of prioritization of initiatives and emphasis on out reach services. The phase I (1982- 1996) represented a focus on tackling child mortality, Phase II (1996-2005) represented a focus on tackling maternal mortality while Phase III (1996-2007 and onwards) represented a focus on tackling neonatal mortality. Each phase signified a focus on different components of the programme although all services were rendered. The focus determined the key service delivery mechanisms and the corresponding requirement of activities and infrastructure, which enabled the identification of "key or strategic resources". This deliberate strategy was executed by establishing a consistent policy of expanding capacity of Medical colleges and Para medical schools; ensuring feeder cadres for key field staff and a balance between aspirations of public at large, top management (directorate) and political representatives (ministry). This ensured provision of resources based on merits of initiatives and commitment of resources over time. The top management ensured establishment of process monitoring systems, a well developed reporting and data validation system and insisted on better micro planning of initiatives. They were receptive to introduction of new concepts from medical colleges, field and international agencies which enabled them to act as the locus for introduction of innovations. All these facilitated the establishment of reliable data which facilitated better evidence based planning. It also resulted in a consistent monitoring and feedback system that facilitated process corrections through learning and consistent system adaptation. The emphasis on training by ensuring a greater interaction with medical colleges, international agencies along with an emphasis on technical inputs helped transfer of knowledge and skills to departmental training institutes. They in turn transferred them to the field staff in line with the change in services being provided over time, phase wise. On the personnel front, the centralized management of personnel matters in the headquarters directorate of public health facilitated prompt regularizations and promotions. It also allowed establishment of a system of counseling for postings enabling staffing of geographical areas that were having poor facilities in form of transport and educational infrastructure. The processes of recruitment used merit list of trained candidates for field staff and had a provision for recruitment of medical officers on temporary basis through employment exchanges that enabled filling of vacancies at shorter notice. There was a deliberate policy of posting of specialists to FRU s only, which enabled

availability of specialists. MOs were motivated to stay through training initiatives and sending them for postgraduate studies on government sponsorship. All these facilitated availability, timely selection and appropriate distribution of skilled staff including specialists. Finally there was a consistent system of planning and development of infrastructure in form of increased number of PHCs, SCs and induction of equipment and technology in line with services planned. Linkages with the community in form of direct interaction of officers, out reach camps and representations enabled alignment of services with their needs. The policy of Involvement of NGOs, PPs and community workers allowed sourcing of resources from the community.

The interaction of all these factors is represented as figure 2 (see page below). Thus, a deliberate strategy executed through aligned policy and directorate decisions ensured aligned and improved service delivery. This ensured a consistent fall in the indicators of IMR, BR, MMR and TFR. The key to this success was the mechanisms which ensured consistent availability of field staff, MO and specialists, thus ensuring minimal vacancies. Decisions consisting of personnel decisions, training, posting, incentives, skills up gradation, alignment of infrastructure and services in line with community needs assessment also contributed significantly.

These factors ensured consistent “MOs motivation to produce”. The “MOs motivation to produce” enabled management of workload, helped maintain motivation and discipline of staff, thereby ensuring appropriate and improved service delivery. Although the development of infrastructure was consistently seen from 1986, it is the introduction of innovations like process monitoring and feedback systems and skills transfer for tackling Maternal and infant mortality from 1996 that the rate of fall in the indicators of BR, IMR, MMR and TFR increased. This, in all probabilities was built on the efforts of the health system in the years prior to 1996.

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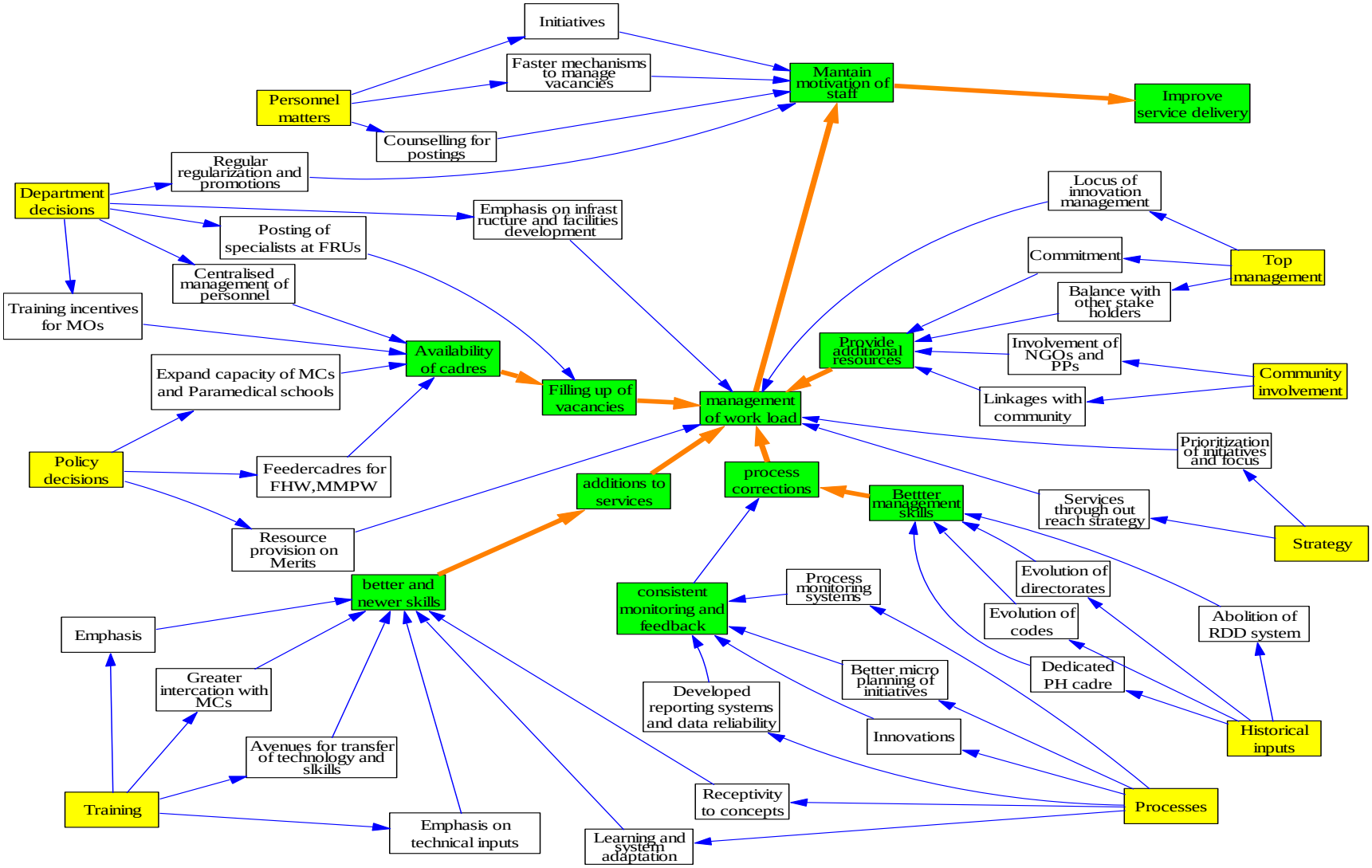

Figure 2: Factors influencing performance of the health system in Tamil nadu

Comparative analysis across the cases: The important question is how and why Tamil nadu did better than Gujarat even though both the states were exposed to the same programme environment in terms of financing by government of India, same technical support including international agencies and near similar health status of the population**.** To understand and answer this question we did a comparative analysis on two key aspects—the processes adopted for implementation of the programme and the process of innovation and in turn the strength of capability of innovativeness. The comparisons are placed as Tables 4 and 5 below:

Table 4: Comparison of in use of programme processes and activities across state's health system

Characteristic	Tamil nadu	Gujarat
	Attention mechanisms	
Issue identification	· Provision and management of Doctors, specialists, and field staff	· Emphasis on savings on resource provision
	· Emphasis on training and introduction of knowledge and skills	· Community as resource provider
	· Political commitment for resource generation	· lack of emphasis on skills and knowledge up gradation
	· Efficiency of use of resources	· absolute control by top management
	· Emphasis on monitoring and feed back	· absolute adherence to rules
	· Development of infrastructure	· decentralized provision and management of staff
	· Focus on community needs	
Issue incorporation mechanisms	Attention and environmental scanning of top management, community feed back, pilot studies	Uncoordinated individual initiatives
Knowledge exchange mechanisms	Interactions with International agencies, Medical colleges, community, training institutes, training evaluation mechanisms, pilot studies.	Training institutes,
Users	All staff, management, doctors	All staff, management, doctors
Feedback mechanisms	community, training institutes, training evaluation mechanisms, pilot studies, Review meetings	Community , staff, review meetings

Table 5: Comparison across dimensions of process of innovation

Dimension	Tamil nadu	Gujarat
Search for ideas	Top management directed environmental scanning. Specific strategic planning unit	No **specific** mechanism
Willingness to take risks	Calculated	Near zero , not willing
Consistent financial allocation	Seen	Resource conservation leading to impoverished financial allocation
Delinking of explorative and exploitative process	Seen through separate strategic planning unit	Focused on exploitative process only
Connection to outside agencies – depth --numbers	Connected to all international and national health agencies, state medical colleges, NGOs	Minimal
Connection to outside agencies – Breadth—degree of interaction	Very high, positioning of serving officers in international agencies, medical colleges	Minimal

The comparative analysis distinctly highlights the differences across the following issues:

- Resource provisioning
- Environmental scanning for opportunities
- Community interaction
- Emphasis on capability development

A: Resource provisioning: Three critical and interlinked resources –finance, manpower and infrastructure- need to be provided on a consistent basis for effective implementation of any programme. Both the states show contrasting approaches to this aspect.

While Tamil nadu consistently made efforts to provide and was willing to make all out efforts to get resources from both internal and external sources—as indicated below:

- "From early 1950's political leaders would discuss family welfare, small child norm, women empowerment at marriage functions. They attached a lot of importance to building of infrastructure and development of health systems. We see in the election manifesto of this government, two important health programmes were part of it—"varumom kappom thittam and muthulakshmi maternity benefit scheme. The political leadership is very strong and political will is also attached lot of importance in these issues." (Dr Padmanabhan, DPHS, Tamil nadu)"
- **"**My own experience has been that there is no dearth of resources. It all depends upon the person managing it, how we utilize them. If I am going to work within the system and not come out of it, then definitely resources are the constraints. There should not be any pilferage, misuse or wastage of resources. And if they are used for the purpose for which they are meant then there is no problem. Ultimately my objective is to provide services. Till date I have been successful in managing the resources and distributing to the districts. When we go to the government with clear statistics, clear idea of what you are going to do and able to show results, then resources are not a problem. There is no problem of finances if it is acceptable to the government. For last ten years 5-6% of revenue budget is allocated for health." (Dr Padmanabhan, DPHS, Tamil nadu)"
- "Health, irrespective of political affiliations is considered a sensitive subject with people and an important community and political issue. Money is always sanctioned."(Dr Alphonse, Jt Director PHC/SC). "

There is a clear commitment of the top management to the programme and is reflected in form of resource commitment.

In the state of Gujarat what we see is an effort to conserve resources due to an inherent fear of "future financial burden". This is reflected in comments quoted below:

As part of operationalisation of FRU's, staff nurses were recruited on contractual basis to help manage obstetric care. The full financial burden was borne by GOI. It was proposed to pay them a token 50 Rs more than what a regular staff nurse would get (Rs 6200) but without the other perks and benefits. The proposal was implemented in 1999. In 2002-03, the proposal was to be extended to all CHC. The proposal was passed by the empowered committee, supported by GOI with funding. The proposal could not pass the state governments finance department.

- **"No risk taking, lack of understanding of subject**: The apprehension of impending financial liability on state was there. "Oh, how can we give Rs 6250? The teachers are getting 2500/3500 Rs. everybody should get the same. All the staff nurses I recruited resigned and went to other hospitals in Ahemdabad". "The funny thing was that the whole thing was to be reimbursed by GOI. This was the mindset of the people sitting in sachivalaya. People sitting there must be trained or exposed to certain situations. They have not gone to the villages or seen reality or have never implemented programmes. They are just deciding. They are a real bottleneck". (Dr K.P.Patel retired Addl. Director, Family welfare 1999-2003). "
- "The apprehension was that they will be the liability of the state. When bureaucrats say this, the finance minister will also believe it. Ultimately the programme suffers" "RCH I started this. RCH II came and then NRHM. In one form or other support comes". "They say this state is a prosperous state. If you understand this, then certain basic things have to be improved like infrastructure, human resources and health is a key part of it. The people sitting there must understand. The secretaries understand, but section officers and above them do not understand. When it comes to decision making, they do not change or override it" (Dr K.P.Patel retired Addl. Director, Family welfare 1999-2003). "

B: Environmental scanning for opportunities: Under the rural health system, emphasis is on the implementation of the programmes. Due to this the emphasis on internal mechanisms

of innovation is much less. However the scope for identifying improvements in technical processes and improves service delivery is high as international health care orgnisations do identify process innovations and fund their acceptance. This opportunity is available to all state health are systems uniformly.

While Tamil nadu on its own had developed linkages with the medical colleges in their state for improvements in technical inputs to service delivery mechanisms, they were also active in seeking partnerships with international health agencies like DANIDA, WHO and UNICEF. They actively sought to enhance their engagements with these agencies by seeking to position their medical officers in these agencies and advocate partnerships for technical process innovations. This is substantiated by the given below comments:

- "Medical colleges are the places where advances in knowledge and skills are learnt and practiced. Here significant inputs come from various sources voluntarily and in piecemeal form. There is a requirement for transfer of these skills to professionals at the government level. Government PHC doctors must be guided and given practice oriented skills which require strict monitoring and a mechanism to ensure transfer. This training and monitoring is required for a length of time, as time is required to become a good doctor. Thus medical college professionals should actually give inputs on a regular basis and voluntarily to government doctors and staff so that they learn practice oriented skills which translates advances in knowledge and skills into service at the public level." (Dr Jayam, chair person sasthinatha trust)".
- **"**The role of the government is to be proactive in ensuring the transfer and interlinking of skills at all levels. Luckily in Tamil nadu, there has been traditions of interaction between government professionals and medical college professionals and government officers have always been helpful" (Dr Jayam, chair person sasthinatha trust)."
- "My role is to find some evidence and with that send a proposal to the government and try to convince them. Once it gets accepted, it will get implemented. International agencies like DANIDA, UNICEF help in transfer of concepts, knowledge and skills and development of systems. It is the state's initiative to use them for their priorities. " (Dr Padmanabhan, DPHS, Tamil nadu)

- "This has been successfully utilized by Tamil nadu, be it DANIDA, IPP 5, UNICEF or RCH I. The state government is very receptive to initiation and implementation of concepts and so agencies help it by identifying gaps in systems, addressing them with initiatives and pilot projects and scaling these pilots to state level initiatives." (Dr Jayanti, consultant UNICEF).
- We are constantly innovating and constantly improving our services. We do not stop with one activity, we keep on improving. The process goes on and on." (Dr Padmanabhan, DPHS, Tamil nadu).

The critical role of top management in fostering deep interactions with agencies producing knowledge and innovative concepts is facilitated by their desire to look for such concepts. This active search has helped Tamil nadu to transfer knowledge and skills to facilitate implementation of innovative service delivery improvements**.**

Gujarat on the other hand did not seek such active interactions. They did not even take advantage of offered opportunities coming their way as part of national initiatives. Their extreme emphasis on conservation of financial resources and the fear of future financial liability influenced their decision making process. The given below comments substantiate this:

- "It is a practice in Gujarat that district hospitals and CHCs work round the clock and on same lines FRU's were insisted upon to work 24*7. The same concept was not there at PHC level as there would be only one doctor. 24*7 PHCs were taken up as a pilot project in some states like MP or UP where additional inputs were given, but it was not seen in Gujarat." "(Dr K.P.Patel retired Addl. Director, Family welfare 1999-2003)
- "As part of operationalisation of FRU's, staff nurses were recruited on contractual basis to help manage obstetric care. The full financial burden was borne by GOI. It was proposed to pay them a token 50 Rs more than what a regular staff nurse would get (Rs 6200) but without the other perks and benefits. The proposal was implemented in 1999. In 2002-03, the proposal was to be extended to all CHC. The proposal was passed by the empowered committee, supported by GOI with funding. The proposal could not pass the state governments finance department." "(Dr K.P.Patel retired Addl. Director, Family welfare 1999-2003)

C: Community interaction: Research has established that interaction with the end user facilitates the process of innovation (Leiponen 2005). In the case of Tamil nadu, there has been a consistent effort to interact with the community and adapt service delivery mechanisms in line with the requirements of the end user. Many of the innovations have enabled new and improved services. This is substantiated by the given below comments:

- "Expected Due Date motivation is a direct face to face approach with the ANC mother aimed to educate the mothers of the need for regular Ante-natal checkups, good nutrition during pregnancy, personal hygiene and health, preparation for pregnancy and delivery, has communication with field staff and where to go in event of emergency. The other aims are also to create a direct rapport between the mother and the staff and through them communicate to the community at large the services being rendered at the PHCs. Planned out reach camps at each sub centre, turn by turn were held. At each camp, all pregnant women with EDD within the coming three months were approached and educated about how to remain in contact with staff and how to reach the PHC for delivery. At these outreach camps, regular ANC clinics were conducted along with other services. ."(Dr Rajasekharan, DD PHS, Vellore)."
- "Services are monitored also by listening to people, when officers go to the field for inspections and people represent for services. Indirect monitoring of services through the community is ensured through fixed day services in form of out reach camps which are advertised to the public in advance. The plan of the services is distributed in advance to the villages. Indirectly the community starts monitoring." (Dr Padmanabhan, DPHS, Tamil nadu)
- *Community feed back*: "Exit interviews are conducted at the out reach camps about the services given, the extent of satisfaction and services required but not given. Based on the feedback, corrective action is taken. This is done independently." (Dr Padmanabhan, DPHS, Tamil nadu)

While Tamil nadu consistently used the community interactions to promote and adapt services in line with community needs, it also facilitated indirect monitoring and evaluation of services. On the other hand in Gujarat services were dictated by the health department in a top down approach. This resulted in the lack of acceptance of services and an inability to

adapt to changing requirements of the community. Given below quotations substantiate the assessment:

- "The community needs or client centered approach aims to facilitate the community identify its needs of health. For this it is expected that the providers would actually sit with the community as partners and do a collective exercise to identify the needs. In Gujarat, when this was introduced, it was not understood by the state level planners initially. It was not understood by the state level supervisors and so the approach in the field was never a partnership mode. So results did not come. Even in the present times, despite attempts, the approach is still to go and say that we provide these "kitty" of services". (Dr K.P.Patel retired Addl. Director, Family welfare 1999-2003).
- "Mamta abhiyan is done every Wednesday. Here we go and tell that today is mamta day and these services would be given. Actually if we adopted CNAA, mamta day would a day of the villagers. Villagers would celebrate this day and would request the PHC for services to be given on that day. If villagers say that this is mamta day then there will be 100% coverage with community participation and quality will be good. People will enjoy the events. It takes some time for people to understand which requires training, capacity building and carrying out exercises. This should be the done by the district and state administration." (Dr K.P.Patel retired Addl. Director, Family welfare 1999-2003).

D: Emphasis on capability development: Innovations when introduced require skills and knowledge to facilitate their absorption and dispersion. Capability development –consisting of "know how" and "know what" –requires organizational focus on training systems and transfer of skills from trainers to trainees. In Tamil nadu, a great emphasis was placed on skill development through training and this was leveraged to enable implementation of innovative service delivery mechanisms and solutions to problems faced. The following quotes stand testimony to this inference:

- "We have learnt that it is not possible to depend upon professional doctor to render services at the PHC. So we have decided to depend more on trained and skilled staff nurses. We are trying to upgrade skills, not routine, but to a higher level to handle emergencies." (Dr Padmanabhan, DPHS, Tamil nadu).

- "We try to innovate. The problem we have is shortage of specialists. We get a lot of MBBS graduates enrolled in employment exchanges. So we are training raw graduates and using them. We train them in obstetrics and pediatrics and try to post them at PHCs." (Dr Padmanabhan, DPHS, Tamil nadu).
- "The success of Tamil nadu has to a large extent depended upon the mechanisms by which skills were transferred and how systems got developed. Tamil nadu tied up with training institutes to develop and transfer skills. The pilot initiatives in projects like DANIDA, allowed learning and monitoring. Monitoring and evaluation systems were developed under DANIDA and later extended to all districts." (Dr Jayanti, consultant UNICEF).
- *Role of medical colleges in transfer of skills to public health officials:* "Medical colleges are the places where advances in knowledge and skills are learnt and practiced. Here significant inputs come from various sources voluntarily and in piecemeal form. There is a requirement for transfer of these skills to professionals at the government level. Government PHC doctors must be guided and given practice oriented skills which require strict monitoring and a mechanism to ensure transfer. This training and monitoring is required for a length of time, as time is required to become a good doctor. Thus medical college professionals should actually give inputs on a regular basis and voluntarily to government doctors and staff so that they learn practice oriented skills which translates advances in knowledge and skills into service at the public level." (Dr Jayam, chair person sasthinatha trust).

In Tamil nadu, Training is a key mechanism in management of staff. This involves flow of managerial and technical skills. The creators of these skills have been teaching institutions (medical and nursing colleges) for technical skills. For managerial skills and concepts, the creators have been international agencies like DANIDA and the health administrators themselves These skills are exchanged to reside with the trainers in training institutes and district training teams. They transmit these skills to the front line staff for use in service delivery. The training institutes have a regular system of doing field evaluations to check for transfer of skills and concepts and taking corrective actions.

In Gujarat, training was least emphasized. Training schools for field staff were closed. There was a lack of skilled trainers and interactions with medical colleges were minimal. The following quotes support the above argument:

- "The FHW schools were closed due to lack of faculty for training, faculty was not willing to stay in places where schools were there and damage due to earthquake. After 1991, the institutes for MMPW and FHW were closed down although the financial burden is borne by the government of India. This resulted in lack of adequate infrastructure for training and lack of adequate trained staff. There was also the problem of getting adequate staff to work as trainers." (Dr Gajera, CDHO Valsad; (Dr Raval, director SIFHW, Ahemdabad).
- "Prior to 4 years, we did not have identified skilled trainers. We had hierarchically selected people on basis of qualification and experience. Needless to say they may not be good trainers."(Dr Raval, director SIFHW, Ahemdabad).
- *Role of SIFHW:* "Is the pace maker for training. It has to be promoted, supported, accepted and monitored continuously. That requires a dynamic leader. This role was not there earlier. This was considered a management post. Managers may not be good trainers or visionaries. A director of this institute has to understand human resources. A large part of what will happen after 10 years was missing and what they did was always in the present, which was not sufficient. One would have thought of years to come and change accordingly. Today SIFHW is proactive." (Dr Raval, director SIFHW, Ahemdabad).

In summary what we see two contrasting approaches on part of the two states. Tamil nadu was proactive, always seeking ways to solve problems and improve service delivery mechanisms in close consultation with the community while Gujarat showed a very conservative, financially restrictive approach which stifled problem solving and improvements in service delivery although it was also privileged to seek the same help from international agencies and its medical colleges as Tamil nadu did.

The moot question which arises is what explains the contrasting behaviors of the two state health systems? The subsequent discussion answers this question.

Discussion: In the comparative analysis of the cases, we had focused on two critical processes, implementation and its interlinked process of innovation. While the process of

implementation converts the plan of service delivery to fruitition, the process of innovation is the mechanism through which change gets incorporated into service delivery. Organizations need to have structural mechanisms which pay attention (Ocasio 1997; Ocasio and Joseph 2005) and drive these two processes. While resource provisioning (Bower 1971; Bower and Gilbert 2005) allows desired inputs in terms of money, technology and manpower to be allocated for service delivery mechanisms, environmental scanning allows identification of opportunities and ideas for incorporation and resultant improvement in them. Community interaction facilitates matching of end user needs to service delivery components (Leiponen 2005). Capability development (Crossan and Apaydin 2010) is essential to equip the service deliverers with the knowledge and skills to ensure effective delivery. It is the combination of these four elements which leads to consistent adaptation and sustained competitive advantage.

Key to the effective functioning of these processes is the organizational attention(Ocasio 1997) and the architecture positioned for running the innovation process which allows bridging the opportunities in environment with the implementation process.

This structuring can be compared with the mechanisms in humans which lead to learning. The theory of planned behavior (Ajzen 1991) indicates that steps in human learning require first awareness, then attitude formation which drives and sustains the intent for desired action followed by action. Learning occurs across the entire cycle. The components of brain which drive these actions form the architecture. A similar concept can be made applicable to organizations. The Architecture for learning in organizations is what drives the process of innovation and its effectiveness is what determines the strength of the capability of innovativeness (Crossan and Apaydin 2010). This Cognitive architecture (Amin and Cohendet 2004) consists of the mechanisms for creation, exchange, storage, transmission, retrieval and usage of knowledge and skills and finally impact. A mapping of this architecture across the initiatives taken in the health system of Tamil nadu would succinctly explain the concept elucidated above.

The cognitive architecture (The health system of Tamil nadu): This inter-linkage between the creators, the depositories and end users of these skills along with the transmission mechanisms represents the cognitive architecture (Amin and Cohendet 2004) of the health system. (See tables 6, 7 and 8 for details of mapping). It consists of the Medical colleges and

international agencies as creators of knowledge and concepts, Training programmes conducted by these agencies act as exchange mechanisms, the state health systems training institutes and its manpower are repositories of this knowledge and skills, the training programmes of the training institutes becoming the transmission mechanisms to field staff who use them to effectively deliver the services resulting in their impact. This requires that the health system coordinates the identification, flow and assimilation of these skills over time through evaluation, feedback and correction mechanisms so that the initiatives facilitate equipping of staff with appropriate skills, in line with the services being rendered and added in each phase. This necessitates a Cell in the headquarters of the state health system which acts like the brain and does this function. This structural component was distinctly visible in the health directorate of Tamil nadu and they had planned for evolution of this cell at a strategic level. The given below quotes substantiate this assessment:

- "The cell under Joint Director looks after the planning, creation and operationalisation of public health infrastructure. The mechanism of up gradation of public health facilities and services has been driven by the agenda of each incumbent who was the director of public health. There has been no formal structure to this activity. The rate of achievement was directly influenced by the director public health in charge. The planning cell works on a time frame of one to two years. For eg recently they have sent a proposal from the state to central government for sanction of 150 new PHC'S and 1600 SC'S. However, this cell does not take a holistic view of the requirements such as requirement for training, recruitment of manpower. Therefore the aim is to create a cell which will coordinate these activities, say on the lines of an R&D cell. The aim is to develop a system which will appraise, forecast and plan changes in the health system in a holistic way, on a long term basis, as is seen in the railways or the military services" (Dr Kolandaswamy DD research Headquarters).

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Table 6: Flow of technical skills and mapping of architecture for flow

Initiative,	Creator of know-ledge	Exchange-mechanisms	Storage place	Trans-mission mechanisms	Retrieval and usage by	Actions taken	Impact
Quality ANC care	Medical colleges Inter-national. agencies	Courses at medical colleges nursing schools, training courses	Trainers at training centers core trainers Super-visors	Training courses, field sessions On site teaching	VHNs Staff nurses Super-visors MOs, Specialists	Identification of high risk mothers, Screening for gestational diabetes, AIDS, health education of mothers on nutrition and baby care	Better nutritional status in pregnancies , better motivated mothers for adoption of contraception
Emergency care services, Training in blood grouping and MTP	Medical and nursing colleges, UNICEF	Courses at medical colleges, nursing schools, training courses	Specialists , Staff nurses at FRU Core trainers and training institutes	Training courses, field practice sessions On site teaching by supervisors	Staff nurses Medical officers	Ensure 24 hours availability of staff, management of all emergencies	Lesser referrals from PHCs, Higher skill levels of staff at PHCs Including medical officers
MOs Training in anesthesia	Medical colleges	Training at medical colleges	Trained MOs		Trained MOs	Management of emergencies at FRU	Management of emergency operations

Table 7 flow of technical skills and mapping of architecture for flow

Initiative,	Creator of knowledge	Exchange mechanisms	Storage place	Transmission mechanisms	Retrieval and usage by	Actions taken	Impact
New born care	Neonatology units ,MCs UNICEF	Training programmes Documents	Trainers at training institutes	Training courses in field, district level trainers	Community link workers, VHNs, staff nurses, MOs and specialists	Identification, referral and Management of high risk babies, Health education for mothers	Reduced neonatal mortality rates
Emergency obstetric care	Medical colleges, UNICEF	Training programmes Documents	Trainers at training institutes Teachers at nursing colleges	Training courses in field, district level trainers Nursing colleges	Staff nurses Medical officers Specialists at referral units, VHNs	Identification of high risk mothers, Emphasis on institutional deliveries Education of community Referral transport system, functional referral units	Reduced maternal mortality rates
Process of Immunization	WHO	training programmes	Trainers at training institutes	Training courses in field, district level trainers	VHN	health education for mothers, out reach coverage	reduced child mortality
Health education	international agencies	training programmes	Trainers at training institutes	training courses at institutes, field level courses	VHN, Staff nurses	health education for parents, adolescents	increased awareness

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Table 8: Flow of managerial skills and mapping of architecture for flow

Initiative	Creator of knowledge	Exchange mechanisms	Storage place	Transmission mechanisms	Retrieval and usage by	Actions taken	Impact
Verbal autopsies of maternal and child deaths	UNICEF	Training of trainers, administrators Pilot project	Administrators, training institutes	Training courses, Documents	Medical officers and staff, field unit administrators	Monitoring of process, analysis of data generated	Corrections in service delivery.
Rationalization of specialists posting	Analysis of verbal autopsies, administrators at head quarters	Meetings, documents	Administrators at headquarters	Documents	Administrators	Policy of posting only at referral units	Functional referral units
Functional referral transport	Administrators Analysis of verbal autopsies	Meetings, documents	Field level administrators	Documents	Field level officers, and administrators	Management of vehicles Creation of awareness in public Link with detection of emergencies	Reduced morbidity and mortality of mothers and children
Vital events survey	DANIDA	Training of trainers, staff, officers	Training institutes,	Meetings, documents and training courses	Medical officers, staff	Conduct of regular field surveys	Validation of field data, better inputs for planning.

The cognitive architecture and the process of innovation, when mapped on to the process of implementation diagrammatically can be represented as given below:

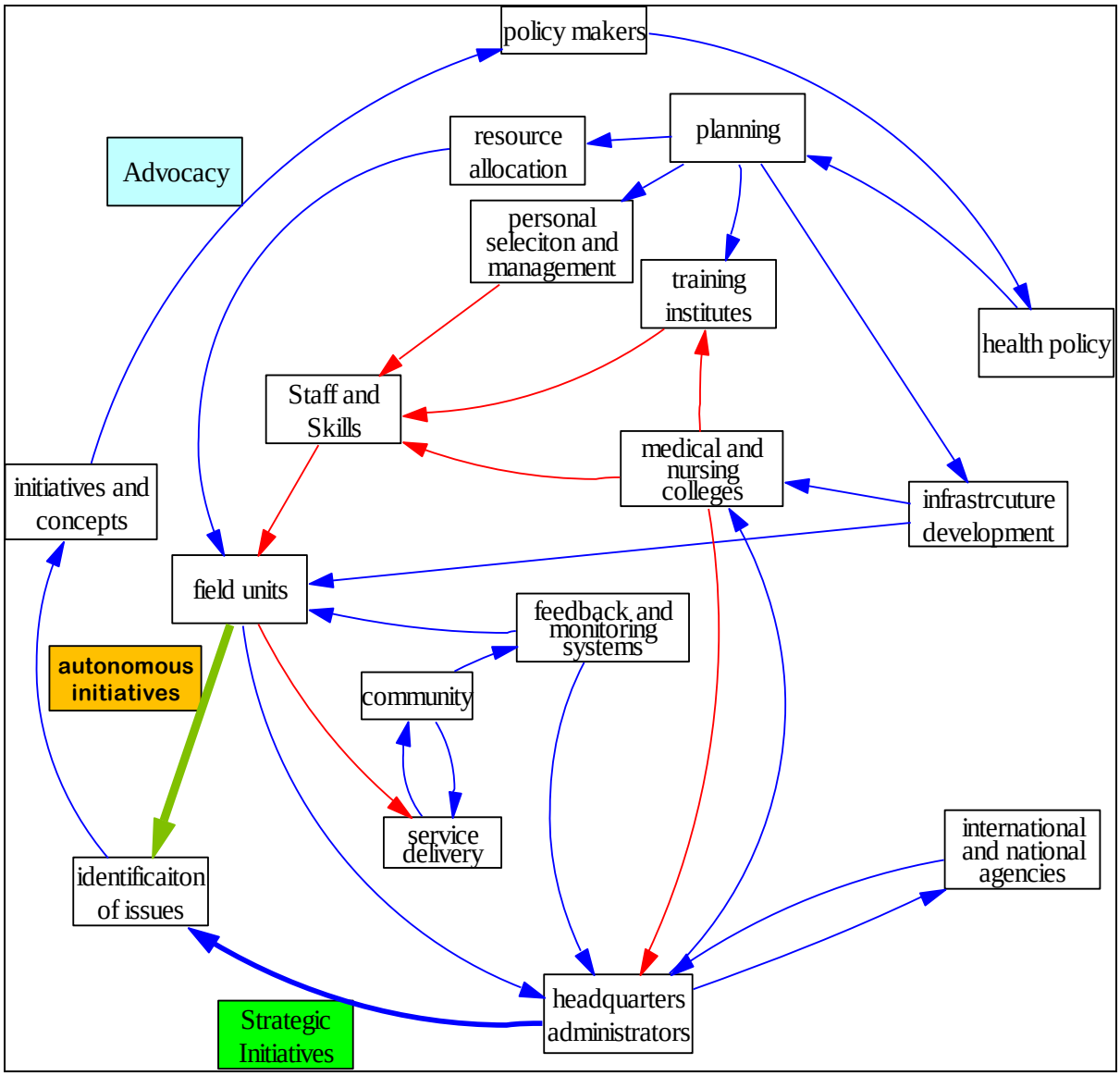

Figure 3: A Grounded model of process of innovation in health care systems.

→*Red arrows indicate Cognitive architecture*

→*Blue arrows indicate the process of implementation*

In summary what we see is a highly functional and effective cognitive architecture as part of the structural elements in the Tamil nadu health system which is not seen in case of Gujarat. This singular difference in the processes being managed by the two state health systems was responsible for the difference in performance under the Reproductive and child health programme.

The effectiveness of the cognitive structure was due to its ability to spot innovative concepts in the environment through its close linkages with external agencies and community and then facilitates its conversion and assimilation into the service delivery components. Thus it acted as an effective link between the processes of innovation and implementation. In sum it defined the strength of the capability of innovativeness in the health system.

CONTRIBUTION AND LIMITATIONS:

This study set out to understand the role of structural elements in the process of innovation and through it performance of an organization. By identifying the key role of a functional Cognitive architecture—a structural element- in driving innovation, this paper has contributed in filling gaps in our knowledge about the process of innovation.

It has also established the key dimensions of the capability of "innovativeness" and its linkage with the process of implementation.

It has proposed an "operationally grounded" and"how to" model of the process of innovation.

The strength of the findings emerges from a comparative study of two cases where all other elements were common and therefore controlled except the process of implementation. Since these findings were established in the context of health care, these need to be established in other contexts of services.

CONCLUSION:

This study has been successful in addressing the theoretical gaps concerning role of structural elements in the process of innovation and through it performance of an organization. It has successfully established the fact that a functional cognitive architecture –a structural element is what orchestrates the process of innovation and with it performance of an organization.

ANNEXURE: List of abbreviations used

MO: MEDICAL OFICER

VHN: VILLAGE HEALTH NURSE

PHC: PRIMARY HEALTH CENTRE

SC: SUB-CENTRE

ICDS: INTEGRATED CHILD DEVELOPMENT SCHEME

IPP: INDIAN POPULATION PROJECT

DANIDA: DANISH INTERNATIONAL DEVELOPMENT ASSISTANCE

UNICEF: UNITED NATIONS CHILDRENS RELIEF FUND

MMR; MATERNAL MORTALITY RATIO

IMR: INFANT MORTALITY RATIO

RTI: REPRODUCTIVE TRACT INFECTIONS

STI: SEXUAL TARCT INFECTIONS

BR: BIRTH RATE

DR: DEATH RATE

LEB: LIFE EXPECTANCY AT BIRTH

UP: UTTAR PRADESH

TN TAMIL NADU

WHO: WORLD HEALTH ORGANISATION

AIDS: ACQUIRED IMMUNODEFICIENCY DISEASES

ADD: ACUTE DIARRHOEAL DISEASES

ART: ACUTE RESPIRATORY TRACT DISEASES

BEmONC: BASIC EMERGENCY OBSTETRIC AND NEONATAL CARE

CEmONC: COMPREHENSIVE EMERGENCY OBSTETRICAND NEONATAL CARE

ANM: AUXILLARY NURSE MIDWIFE

GOI: GOVERNMENT OF INDIA

TFR: TOTAL FERTILITY RATE

NMR: NEONATAL MORTALITY RATE

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